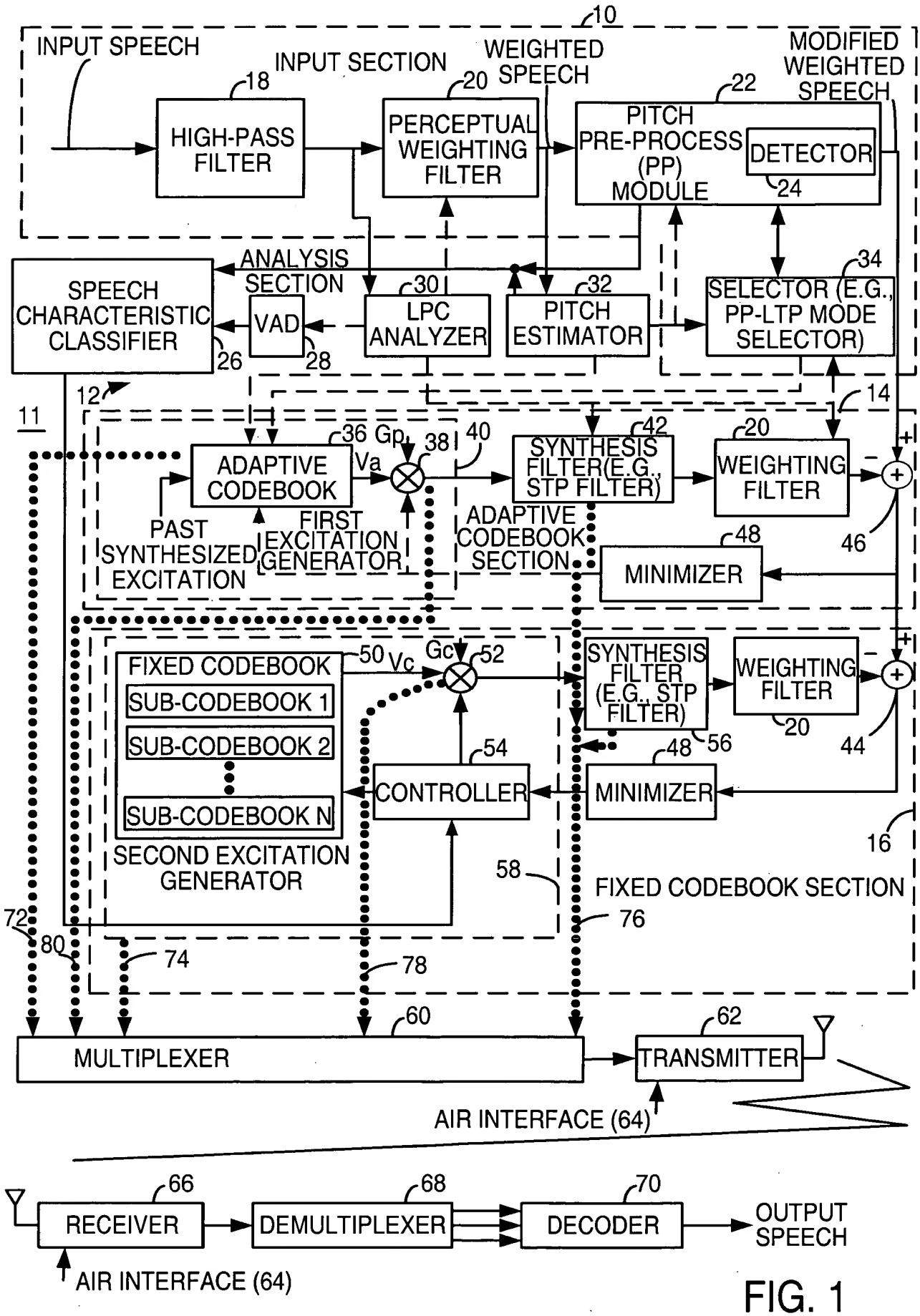
10
INPUT SPEECH
INPUT SECTION
WEIGHTED SPEECH
MODIFIED WEIGHTED SPEECH
18
HIGH-PASS FILTER
20
PERCEPTUAL WEIGHTING FILTER
22
PITCH PRE-PROCESS (PP) MODULE
DETECTOR
24
ANALYSIS SECTION
34
SELECTOR (E.G., PP-LTP MODE SELECTOR)
SPEECH CHARACTERISTIC CLASSIFIER
26
VAD
28
30
LPC ANALYZER
32
PITCH ESTIMATOR
12
14
11
36
Gp
Va
38
40
ADAPTIVE CODEBOOK
42
SYNTHESIS FILTER(E.G., STP FILTER)
20
WEIGHTING FILTER
46
PAST SYNTHESIZED EXCITATION
FIRST EXCITATION GENERATOR
ADAPTIVE CODEBOOK SECTION
48
MINIMIZER
FIXED CODEBOOK
50
Vc
Gc
52
SUB-CODEBOOK 1
SUB-CODEBOOK 2
SUB-CODEBOOK N
SYNTHESIS FILTER (E.G., STP FILTER)
WEIGHTING FILTER
20
44
56
54
CONTROLLER
48
MINIMIZER
16
SECOND EXCITATION GENERATOR
58
FIXED CODEBOOK SECTION
76
72
80
74
78
60
62
MULTIPLEXER
TRANSMITTER
AIR INTERFACE (64)
66
68
70
RECEIVER
DEMULTIPLEXER
DECODER
OUTPUT SPEECH
AIR INTERFACE (64)

FIG. 1

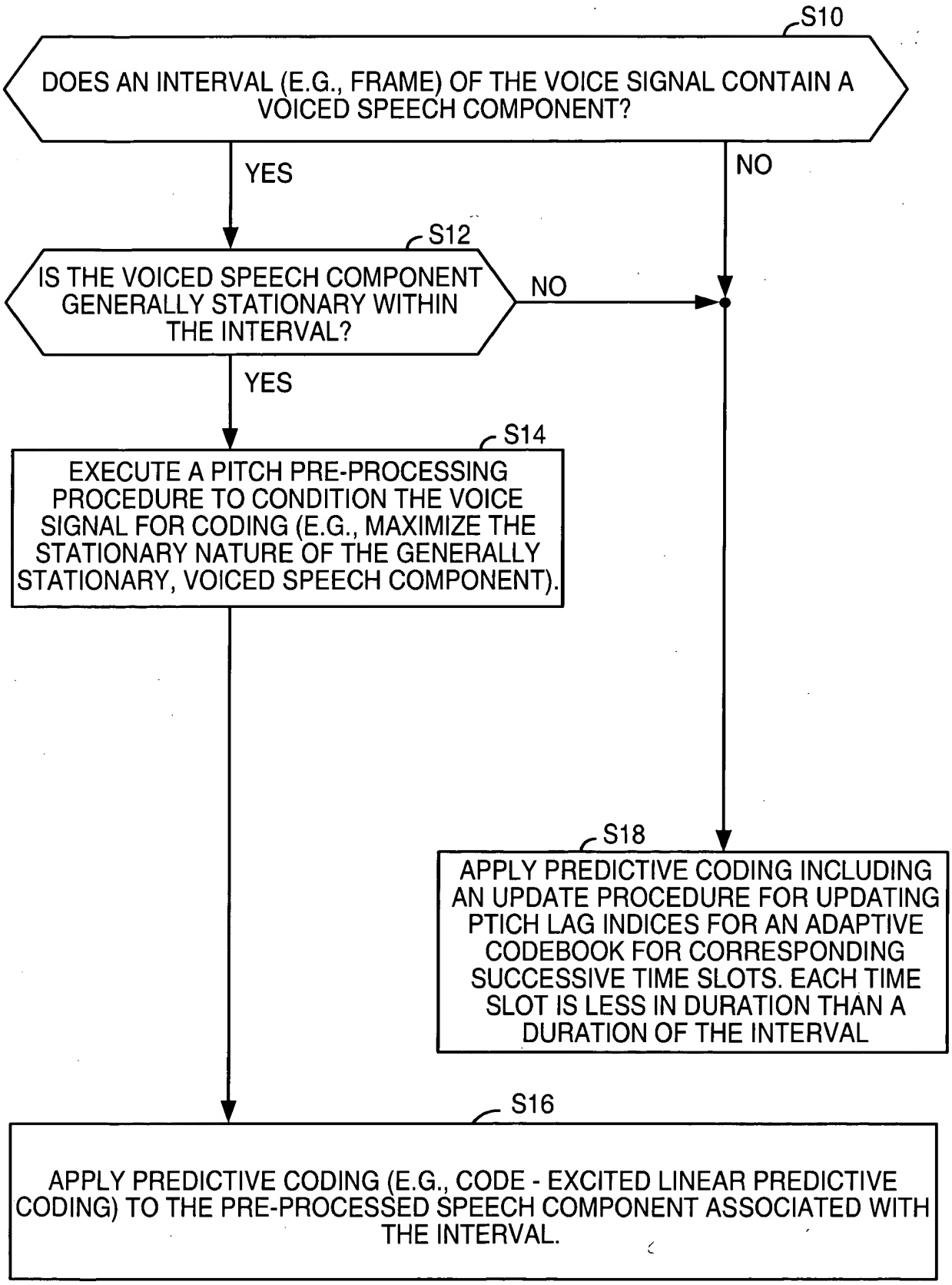
S10
DOES AN INTERVAL (E.G., FRAME) OF THE VOICE SIGNAL CONTAIN A VOICED SPEECH COMPONENT?
YES
NO
S12
IS THE VOICED SPEECH COMPONENT GENERALLY STATIONARY WITHIN THE INTERVAL?
NO
YES
S14
EXECUTE A PITCH PRE-PROCESSING PROCEDURE TO CONDITION THE VOICE SIGNAL FOR CODING (E.G., MAXIMIZE THE STATIONARY NATURE OF THE GENERALLY STATIONARY, VOICED SPEECH COMPONENT).
S18
APPLY PREDICTIVE CODING INCLUDING AN UPDATE PROCEDURE FOR UPDATING PTICH LAG INDICES FOR AN ADAPTIVE CODEBOOK FOR CORRESPONDING SUCCESSIVE TIME SLOTS. EACH TIME SLOT IS LESS IN DURATION THAN A DURATION OF THE INTERVAL
S16
APPLY PREDICTIVE CODING (E.G., CODE - EXCITED LINEAR PREDICTIVE CODING) TO THE PRE-PROCESSED SPEECH COMPONENT ASSOCIATED WITH THE INTERVAL.

FIG. 2

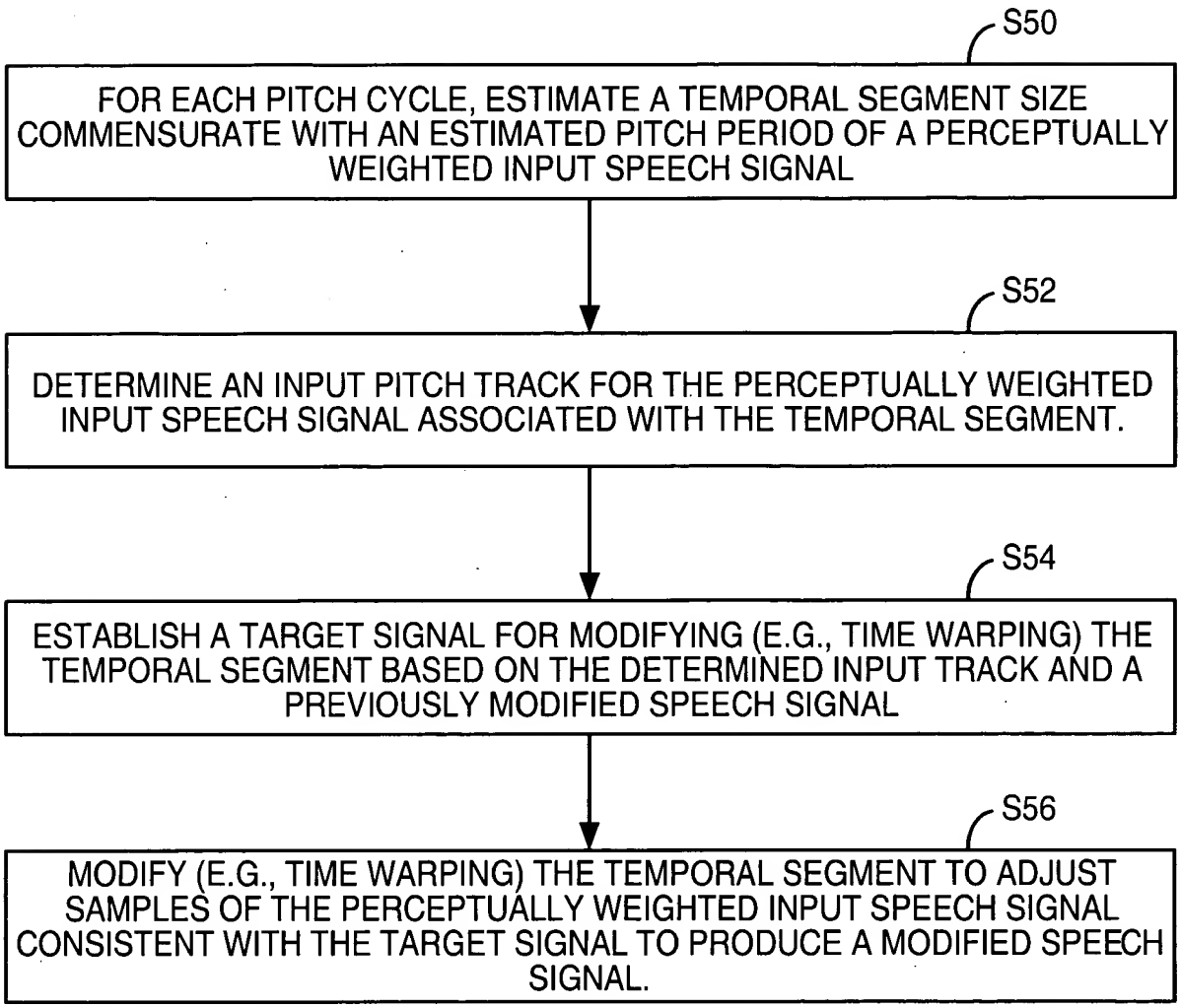
S50
FOR EACH PITCH CYCLE, ESTIMATE A TEMPORAL SEGMENT SIZE COMMENSURATE WITH AN ESTIMATED PITCH PERIOD OF A PERCEPTUALLY WEIGHTED INPUT SPEECH SIGNAL
S52
DETERMINE AN INPUT PITCH TRACK FOR THE PERCEPTUALLY WEIGHTED INPUT SPEECH SIGNAL ASSOCIATED WITH THE TEMPORAL SEGMENT.
S54
ESTABLISH A TARGET SIGNAL FOR MODIFYING (E.G., TIME WARPING) THE TEMPORAL SEGMENT BASED ON THE DETERMINED INPUT TRACK AND A PREVIOUSLY MODIFIED SPEECH SIGNAL
S56
MODIFY (E.G., TIME WARPING) THE TEMPORAL SEGMENT TO ADJUST SAMPLES OF THE PERCEPTUALLY WEIGHTED INPUT SPEECH SIGNAL CONSISTENT WITH THE TARGET SIGNAL TO PRODUCE A MODIFIED SPEECH SIGNAL.

FIG. 3

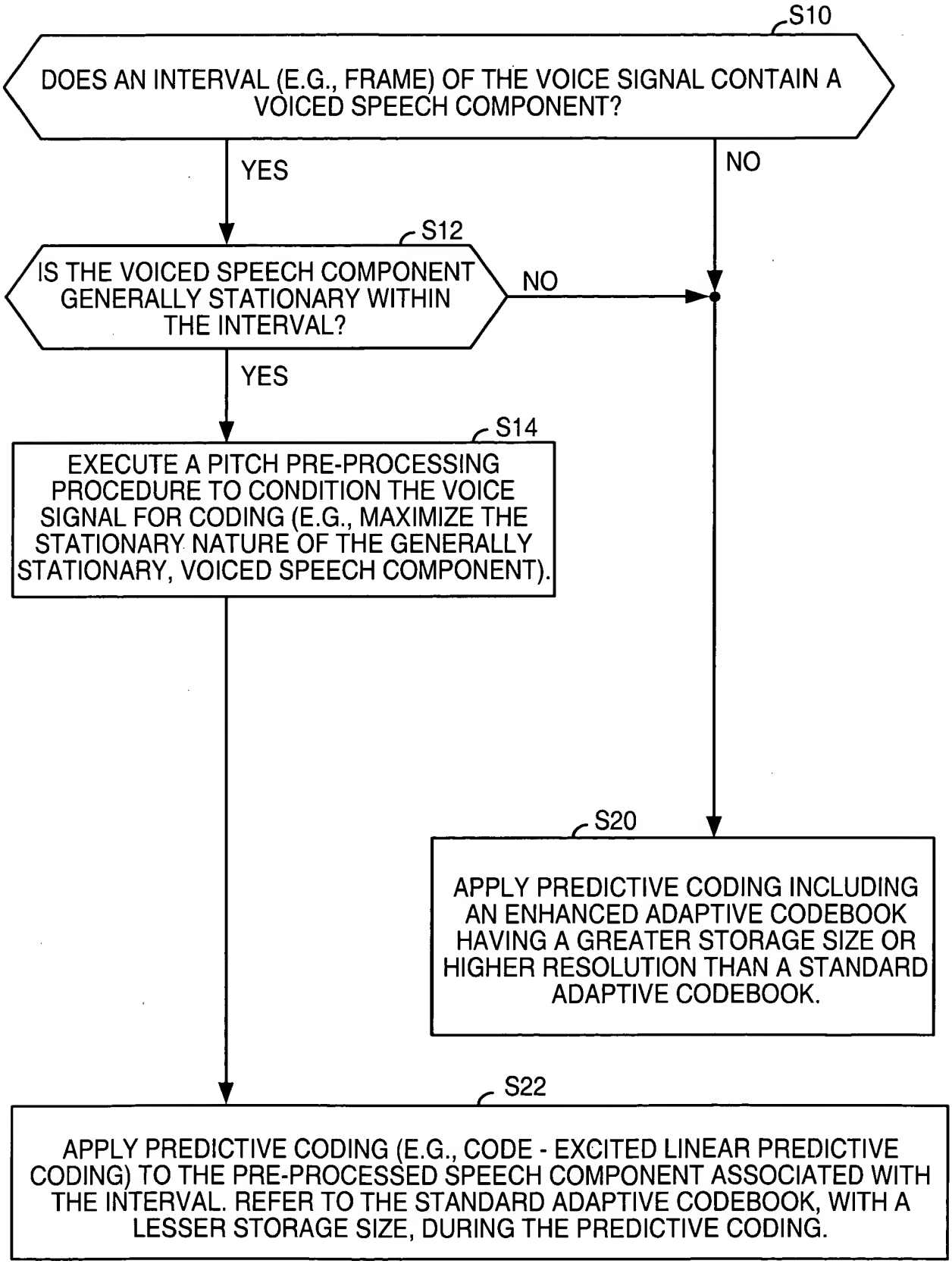
S10
DOES AN INTERVAL (E.G., FRAME) OF THE VOICE SIGNAL CONTAIN A VOICED SPEECH COMPONENT?
YES
NO
S12
IS THE VOICED SPEECH COMPONENT GENERALLY STATIONARY WITHIN THE INTERVAL?
NO
YES
S14
EXECUTE A PITCH PRE-PROCESSING PROCEDURE TO CONDITION THE VOICE SIGNAL FOR CODING (E.G., MAXIMIZE THE STATIONARY NATURE OF THE GENERALLY STATIONARY, VOICED SPEECH COMPONENT).
S20
APPLY PREDICTIVE CODING INCLUDING AN ENHANCED ADAPTIVE CODEBOOK HAVING A GREATER STORAGE SIZE OR HIGHER RESOLUTION THAN A STANDARD ADAPTIVE CODEBOOK.
S22
APPLY PREDICTIVE CODING (E.G., CODE - EXCITED LINEAR PREDICTIVE CODING) TO THE PRE-PROCESSED SPEECH COMPONENT ASSOCIATED WITH THE INTERVAL. REFER TO THE STANDARD ADAPTIVE CODEBOOK, WITH A LESSER STORAGE SIZE, DURING THE PREDICTIVE CODING.

FIG. 4

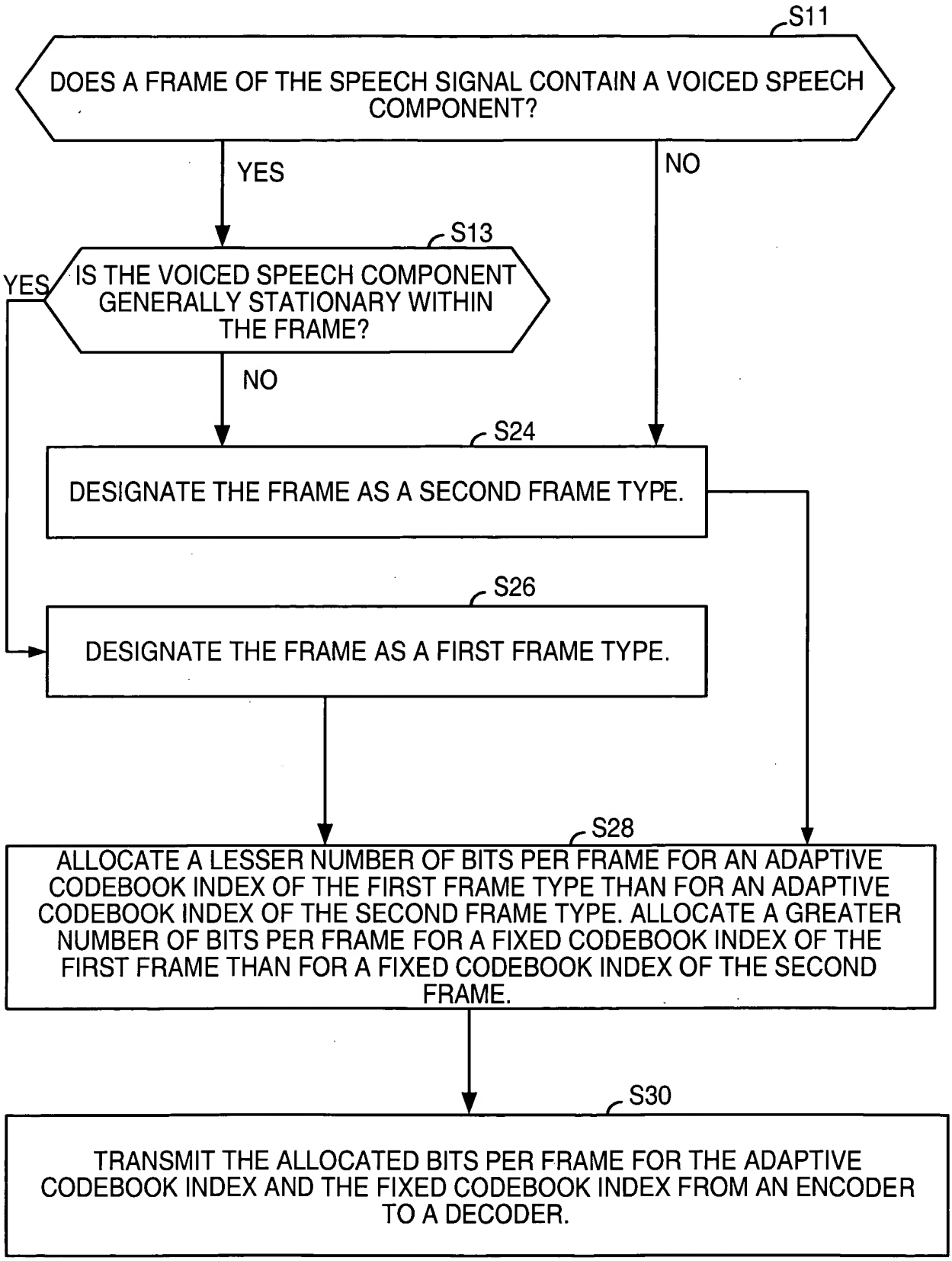
S11
DOES A FRAME OF THE SPEECH SIGNAL CONTAIN A VOICED SPEECH COMPONENT?
YES
NO
S13
IS THE VOICED SPEECH COMPONENT GENERALLY STATIONARY WITHIN THE FRAME?
YES
NO
S24
DESIGNATE THE FRAME AS A SECOND FRAME TYPE.
S26
DESIGNATE THE FRAME AS A FIRST FRAME TYPE.
S28
ALLOCATE A LESSER NUMBER OF BITS PER FRAME FOR AN ADAPTIVE CODEBOOK INDEX OF THE FIRST FRAME TYPE THAN FOR AN ADAPTIVE CODEBOOK INDEX OF THE SECOND FRAME TYPE. ALLOCATE A GREATER NUMBER OF BITS PER FRAME FOR A FIXED CODEBOOK INDEX OF THE FIRST FRAME THAN FOR A FIXED CODEBOOK INDEX OF THE SECOND FRAME.
S30
TRANSMIT THE ALLOCATED BITS PER FRAME FOR THE ADAPTIVE CODEBOOK INDEX AND THE FIXED CODEBOOK INDEX FROM AN ENCODER TO A DECODER.

FIG. 5

ENCODING SCHEME	FIRST ENCODING SCHEME 99		SECOND ENCODING SCHEME 97	
FRAME DURATION	20 ms		20 ms	
FRAME TYPE	1ST FRAME TYPE (4 SUBFRAMES)		2ND FRAME TYPE (4 SUBFRAMES)	
FILTER COEFFICIENT INDICATORS (E.G., LSF'S) 76	1ST STAGE 2ND STAGE 3RD STAGE 4TH STAGE	7 BITS 6 BITS 6 BITS 6BITS 25 BITS	INTERPOLATION 1ST STAGE 2ND STAGE 3RD STAGE 4TH STAGE	2 BIT 7 BITS 6 BITS 6 BITS 6BITS 27 BITS
TYPE INDICATOR 71		1 BIT	1 BIT	
ADAPTIVE CODEBOOK 72	8 BITS/FRAME	8 BITS	8,5,8,5 BITS/SUBFRAME	26 BITS
FILTER CODEBOOK 74 INDEX	8 - PULSE CODEBOOK	2^{30} ENT./SUBFRAME	5 - PULSE CODEBOOK 5 - PULSE CODEBOOK 5 - PULSE CODEBOOK	2^{21} ENT./SUBFRAME 2^{20} ENT./SUBFRAME 2^{20} ENT./SUBFRAME 2^{22} ENT./SUBFRAME
80	30 BITS/SUBFRAME	120 BITS	22 BITS/SUBFRAME	88 BITS
ADAPTIVE CODEBOOK GAIN	4D PRE VQ/FRAME	6 BITS	2D VQ/SUBFRAME	7 BITS/SUBFRAME 28 BITS
FIXED CODEBOOK GAIN 78	4D DELAYED VQ/FRAME	10 BITS		
TOTAL BITS	170 BITS		170 BITS	

FIG. 6

Patent Application for: SYSTEM FOR SPEECH ENCODING HAVING AN ADAPTIVE ENCODING ARRANGEMENT
Inventor: Su et al.
Serial No. 09/663,002

ENCODING SCHEME	THIRD ENCODING — 103 SCHEME		FOURTH ENCODING — 101 SCHEME	
FRAME DURATION	20 ms		20 ms	
FRAME TYPE	3RD FRAME TYPE (3 SUBFRAMES)		4TH FRAME TYPE (2 SUBFRAMES)	
LSF'S — 76 FILTER COEFFICIENT INDICATORS (E.G., LSF'S)	1 BIT 7 BITS 7 BITS 6 BITS 21 BITS		PREDICTOR SWITCH 1ST STAGE 2 STAGE 3RD STAGE	
TYPE INDICATOR — 71	1 BIT		1 BIT	
ADAPTIVE CODEBOOK — 72	7 BITS/FRAME	7 BITS	7 BITS/SUBFRAME	14 BITS
FIXED CODEBOOK INDEX 74	2 - PULSE CODEBOOK 3 - PULSE CODEBOOK	2^{12} ENT./SUBFRAME 2^{12} ENT./SUBFRAME 2^{13} ENT./SUBFRAME	2 - PULSE CODEBOOK 3 - PULSE CODEBOOK GAUSSIAN CODEBOOK	2^{14} ENT./SUBFRAME 2^{13} ENT./SUBFRAME 2^{13} ENT./SUBFRAME 2^{15} ENT./SUBFRAME
80	13 BITS/SUBFRAME	39 BITS	15 BITS/SUBFRAME	30 BITS
ADAPTIVE CODEBOOK GAIN	3D PRE VQ/FRAME	4 BITS	2D VQ/SUBFRAME	7 BITS/SUBFRAME 14 BITS
FIXED CODEBOOK GAIN 78	3D DELAYED VQ/FRAME	8 BITS		
TOTAL BITS	80 BITS		80 BITS	

FIG. 7

Patent Application for: SYSTEM FOR SPEECH ENCODING HAVING AN ADAPTIVE ENCODING ARRANGEMENT
Inventor: Su et al.
Serial No. 09/663,002